But these lists, valuable as they are, contain but a very small portion of the results we may hope for. The committees on sections used in ship building, on locomotives, and on electrical plant, each appeal to an enormous industry, and in each of these there is much that can be standardised. Take, for example, the various sizes and speeds used in dynamos and motors, the numerous voltages in electric light and power systems, and the varying frequencies of alternators. The committee on electrical plant, of which Sir Wm. Preece is chairman, has subcommittees on electric generators, motors, and transformers under Colonel Crompton, on telegraphs and telephones under Mr. Gavey, and on cables under Mr. R. K. Gray.

Both in America and in Germany committees on the standardisation of electric plant have reported within the last few years, and the value of their work is generally recognised; their results will be of distinct service to the English committee when the time comes to frame its report. Meanwhile one important industry has already acted. The lists of standard sizes issued by the Cable Makers' Association carry out in an admirable manner the principle of standardisation. There is no doubt that the belief expressed by the association that the adoption of these standards will act equally for the benefit both of the purchaser and of the manufacturer is well founded, and it is greatly to be hoped that they may be adopted.

Standardisation, of course, has its dangers; it may tend to crystallise the form of products, and thus to delay progress. These possible dangers are clearly before the minds of the practical men who form these various committees, and will have due consideration in their reports. Meanwhile, we can only repeat that the need for standardisation is enormous, and its advantages immense.

The announcement contained in the papers recently that a vote of 3000*l*. for the work of the committee is to be included in the estimates for 1903–1904 is a gratifying recognition of the value of its work, and Sir Francis Hopwood expresses the view of all qualified to judge when in his letter intimating this grant he writes:—

"The Board of Trade desire me to state that they regard the work undertaken by the committee, including as it does the preparation of standard specifications for engineering works, and of standard sections of rolled iron and steel, together with the standardisation of parts of locomotives and electrical appliances, as tending to reduce both the cost of production and the time occupied in completion, and as being of the highest value to the country at large."

But, as has been already said, the work yet accomplished is but a small fraction of that which remains to be done, and the further reports of the committee will be eagerly expected by engineers.

ITALIAN VISIT OF THE INSTITUTION OF ELECTRICAL ENGINEERS.

THE Institution of Electrical Engineers has just completed a visit to northern Italy to inspect the chief works of engineering interest. The Institution has made several continental visits of this kind during the last few years, and although it is difficult to gather much in the way of detail on such occasions, it nevertheless seems to be helpful to many to get some general ideas of what our neighbours are doing, and at the same time to get the advantage of a little pleasure from the scenery which, in this case, is among the most beautiful to be found in Europe.

Probably the piece of work that was looked forward to with the greatest interest was the electric railway from Lecco to Sondrio and Chiavenna on the Ganz system, as it forms a bold experiment, and is the first of its kind. The total length is sixty-three miles. The electric energy is generated by three-phase machines at 20,000 volts, and is transformed down at nine points along the line to 3000 volts, this comparatively high voltage being taken direct by the trolley to the motors. Voltage as high as this necessitates many unusual precautions of an interesting kind; for example, the rheostats and switches are worked pneumatically, so that the driver does not operate direct any apparatus subject to high tension. The method of coupling up the motors is also interesting from its novelty. Instead of working the motors in the usual way, they are divided into high and low tension motors. The high pressure current is taken only to the stators of the high tension motors; the rotors of these machines are used to supply low tension three-phase current to the stators of the low tension motors. The low tension motors are thus supplied with current at a lower frequency than the main current. This "cascade" method of working is continued until half speed is attained, when the low tension motors are cut out and full speed is reached on the high tension motors alone.

The recent arbitration, in which it was decided not to use the Ganz system for the Metropolitan Railway, is still fresh in the minds of most people. Although this system does not seem so suitable for cases in which the acceleration at starting and the speed must be high, it should certainly afford a cheap method of working long lines not having much traffic. As seen at Valtellina, the ease and smoothness of working were all that could be desired.

On looking at the boldness of the experiment, one cannot help being struck by the difference between Italy and our own country in taking up a thing of this kind. But it must not be forgotten that one of our greatest sources of wealth tends to keep us from using electrical methods. If the price of coal were double its present value, which is the sort of price which holds in Italy, then the coal bill would be a larger proportion of the whole cost, and it would be more worth while to attempt a saving.

The usual form of electric traction by means of direct current at 650 volts, transformed from high tension three-phase, was seen on the line from Milan to Gallarate and Porto Ceresio. This line is forty-seven miles in length, and also differs from that to Valtellina in having much heavier traffic and higher speeds, and in being partly worked by steam. It is therefore of great interest to those who are at present considering the electrical working of our main lines.

Overhead lines are, of course, a feature of every long-distance transmission. It does not seem to be generally realised how much we have to pay for putting all conductors underground, though this subject will no doubt come forward more prominently when our large power distribution companies get really to work. One disadvantage of overhead lines is that they are subject to lightning discharges. Many protecting devices have been tried, and a particularly interesting one was seen at the Monbegno generating station on the Valtellina line. It consisted of jets of water forming a permanent earth, but of such a resistance that the loss does not amount to more than about 2 kilowatts. The action is said to be very satisfactory.

At Milan several large works were visited, and also the Royal Technical Institute. The latter is not very large, but is usefully equipped. The room for electrical measurements contains instruments in one group for measuring all the usual quantities over a wide range. In the motor and dynamo testing room the

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most interesting piece of apparatus was a three-phase motor carried on a suspended bed, so that the torque could be measured, and driving a dynamo coupled direct to the end of the shaft. The other end of the motor spindle was fitted with a disc divided into black and white sectors, so that the slip of the rotor when driving the dynamo at various loads could be directly observed by the stroboscopic effect produced on illuminating the disc with an incandescent lamp on the mains supplying the current. There are also two other small motor generators, and a motor of about three horse-power fitted with an electromagnetic brake disc.

The photometry room contains a Lummer Brodhun photometer with Hefner Alteneck standard for general photometric work. For variations of light in arc lamps, as shown by the illumination in a plane, a photometer due to Prof. Rousseau is used. This consists of a vertical disc with two radial arms carrying mirrors. The arc is placed in the axis on one side of the disc, and the light is reflected by the mirrors on to the other side, where it gives two shadows of an axial rod. One of the arms and the mirror on it being conveniently clamped, the other arm is moved from point to point, and the mirror on it is adjusted until the shadows are equally intense as in a Rumford photometer. The variation of the light is thus found in terms of the fixed direction, and the absolute value of this is found, if desired, by means of a Weber photometer.

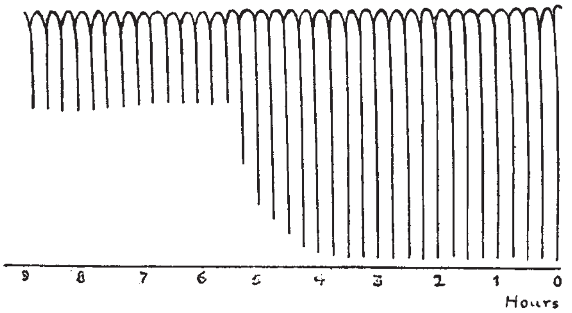

FIG. 1.—Graphic record of cement test.

The engineering laboratories contain a small experimental steam engine and other plant, including a dynamo driven by a high speed steam engine, a gas engine and pumps. Complete efficiency tests are carried out, of which the students are required to write detailed reports. There is also a 100 ton testing machine. This is worked hydraulically, the town water being received at three atmospheres and transformed to 250 atmospheres. There is also a fine adjustment worked electrically, the forward or reverse motion being put on by an electromagnetic coupling.

At the time of the visit tests were being made on the deflection of cement beams used for arching in floor work. They were being loaded up to the point of fracture.

One of the most interesting pieces of apparatus was that used for testing the setting qualities of Portland cement. For testing, the cement is made up in a mould about 3 inches in diameter and 1½ inches thick. This is rotated slowly about its axis by clockwork, which allows a needle weighted with 300 grammes to fall once every quarter of an hour. If the cement is soft, it pierces the cement to the bottom, but as hardening sets in the needle does not pierce the full thickness, until finally it fails to make any impression. The result is automatically recorded as shown in the figure (Fig. 1), in which the ordinates represent travel of the needle, and abscissæ time. It will be noticed that the effect of hardening in this example appeared after about 4 hours, and the needle failed to make an impression after 5½ hours.

The Italian visit made it evident that not only was beautiful scenery to be enjoyed, but that Italy is at present the home of some of the most interesting and original engineering works.

NOTES.

THE Royal Society's Croonian lecture will be delivered on Thursday, April 30, by Prof. Klement A. Timirjazev, upon "The Cosmical Function of the Green Plant."

A CORRESPONDENT informs us that on April 1 Dr. G. V. Neumayer left the Deutsche Seewarte at Hamburg, of which he had been director since 1876.

A REUTER message from St. Petersburg announces that the Imperial Russian Geographical Society will send a scientific expedition into Mesopotamia during the year. The expedition will be under the leadership of M. Kaznakoff, and will include among its members M. Alferaki, zoologist, and M. Tolmatcheff, geologist.

THE President of the Board of Agriculture has appointed a Departmental Committee to investigate experimentally and to inquire into and report upon:—(1) The composition and essential constituents of efficient dips and other preparations for the treatment and dressing of sheep, and their effect upon the animal treated or dressed, and upon the parasites and other organisms for the destruction of which they are used; (2) the methods in which such dips and other preparations should be employed, and the appliances and facilities requisite for the purpose; (3) the times and intervals at which sheep should be treated or dressed, regard being had (*a*) to the life-history and characteristics of the sheep-scab Acarus and of the other parasites and organisms of sheep which require external treatment, and (*b*) to the practical conditions under which sheep-farming is carried on in various parts of the United Kingdom. The committee includes Dr. T. E. Thorpe, C.B., F.R.S., Prof. J. R. Campbell, Mr. A. C. Cope, Mr. M. Hedley, and Dr. W. Somerville. Prof. Winter will act as secretary to the committee.

MR. W. DE FONVIELLE writes to say that for the first time since the Eiffel Tower was open to the public in 1889, it was used for astronomical purposes on the occasion of the recent lunar eclipse (April 11–12), when a number of members of the Société astronomique de France spent some hours making observations on the terrace of the monument at an altitude of about 870 feet above the Seine.

A REUTER telegram from Colon states that slight shocks of earthquake occurred there and at Panama on the morning of April 17.

THE *Athenaeum* announces the death, in his seventy-third year, of Prof. Laborde, of the Paris School of Anthropology, and of M. E. Duporcq, the secretary of the French Mathematical Society, at the early age of thirty-one.

A GENERAL agreement has been arrived at between Marconi's Wireless Telegraph Company and a group of Danish financiers in Copenhagen for the establishment of a wireless system between Iceland and the north of Scotland.

THE following announcement appeared in Saturday's *Times* (April 18):—"Owing to the breakdown of a subsidiary device employed in connection with one of the telegraph stations established by the Marconi Company for

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